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ABSTRACT

A study was conducted to examine the various mental processes that occur during listening. Fifteen volunteers at an eastern United States college listened to a 14-minute taped lecture. The participants pressed a button, connected to a light hidden from their view, each time their minds wandered from the specifics of the lecture. They were then asked to write down all they could remember, to answer open-ended questions to trigger the retrieval of sorted ideas not freely recalled, and to report on their intervening thoughts. The mean percentage of exact recall in short term memory was 22%, and the mean percentage of unaided recall in long term memory was 28%. The most frequent intervening mental process was imagery, which was helpful in aiding recall 68% of the time, but was also occasionally disruptive. Mind wandering was the next most frequent intervening behavior, occurring mostly at the more abstract points of the lecture. The findings suggest that educators should employ techniques to aid information processing, such as outlines and diagrams, improved verbal delivery, or suggesting that students list the main points before leaving the lecture. (HTH)

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Recall and Intervening Mental Activities Involved in Listening to Expository Information

There is a dynamic and intricate interrelationship among mental processes occurring during the act of listening which needs to be explored. To investigate that interrelationship and to discover what the mind is doing while listening, college subjects were tested individually while listening to a lecture. Special apparatus was devised so that subjects could signal the manifestation of intervening mental processes such as imaging and mind wandering which could be reported retrospectively and then analyzed according to a post hoc schema. In addition, recall protocols were analyzed to measure the recognition of the structure and hierarchy of ideas, and the interactive dynamics between listener and the message.

Review of Related Literature

Accuracy of Recall

Because we cannot look into the mind directly, hypotheses about the nature of memory and the variables which affect the level of accuracy have been obtained by an examination of recall protocols. Bartlett (1950) in his seminal study, deliberately used a mystical, and bizarre story, "War of the Ghosts" in order to test the accuracy of recall after different intervals of time. He found that accuracy of recall was the exception and that protocols contained distortions, importations, and rationalizations because of the ambiguities in the story. In addition, there was

CS206335

an increasing tendency towards importations and inventions in "long distance remembering."

Since the advent of Bartlett's study, researchers have been divided into two camps. The first group, the abstractivists, contend that recall disclosure is basically accurate and reproductive in nature, and is a function of such variables as the number of concepts in the text base, degree of redundancy, and level of concreteness or imagery evoked by the passage (Kintsch and Kozminsky, 1977; Meyer, 1975). Gauld and Stephenson (1967) found that the nature of instruction affected the results. Thus, when subjects were instructed to avoid errors and not fill gaps in memory after a reading of the "War of the Ghosts," accuracy ratings improved substantially, which disproved Bartlett's findings. However, in the non-experimental world, such demands for accuracy are not typical.

The second group, the reconstructivists, believe that the level of accuracy is "problematic" because it is affected by intervening variables such as previous experience, the contextual situation, and explicitness of information (Frederiksen, 1975; Marshall and Glock, 1978-79; Spiro, 1975). Spiro (1975) found that the level of accuracy could be predicted by the nature of the stimulus message, task demands, and the level of "cognitive and affective interaction." Thus when material was well organized and neutral in impact, the level of accuracy tended to be greater; conversely, when there was a high degree of affective interaction, the level of accuracy tended to diminish.

Current research seems to be moving towards an analysis of the interaction between subject and the information and is somewhat less concerned with accuracy. Reder (1978) suggests that the level of interaction is reflected by the production of elaborations (idiosyncratic and

optional responses including inferences, embellishments, and additions). According to her view, elaborative behavior helps in the retention of prose and should be encouraged.

Imagery and Memory

During the listening act, the mind is using various cognitive tools to aid in storage, retention, and recall. One very important tool is imagery which has now been resurrected as a legitimate field of inquiry. Until recently, the field of learning was dominated by behavioral psychologists who were more concerned with easily measured stimulus variables in learning and chose to ignore how the learner interacted with the stimulus material. The resurgence of interest in imagery has helped contribute a more dynamic and humanistic approach to learning fostered by the work of Bruner (1964), Piaget and Inhelder (1971), and Paivio (1971). Paivio, who made an impressive empirical and theoretical contribution to the role of imagery and learning, hypothesized that there are two basic and alternative ways of representing information in memory--the verbal and the imaginal which overlap and interact. He also hypothesized that memory increases directly with the number of alternative codes available for retention. Imagery has been used as a variable in discourse recall performance in a number of studies with positive results (Anderson and Hidde, 1971; Johnson, 1974). Steingart and Glock (1979) found that the use of imagery facilitated comprehension and helped generate the production of inferences significantly.

Signalling Intervening Mental Activities

Two researchers used a device to signal the occurrence of intervening mental activities in their research design. Horowitz (1970)

instructed her subjects to report on the "contents of their minds" at different tone signals while viewing a "trauma" film. After completion of the first recall protocol, subjects were then told to review their protocols and to add "...all clear instances of imagery, amplifying previous reports if necessary on a separate sheet of paper." Interestingly, reports on the appearance of imagery were doubled after instruction to record imagery. The weakness in this study was that introspective reports were not spontaneously generated. Cohn, Hansel, and Sylvester (1971) devised an innovative technique to measure instances of mind wandering experienced by students during a lecture. In order to record the number of times students became aware that their minds had wandered, they were instructed to push a button which was located at their desks. Equipment was specially designed so that when a student pushed a button, a corresponding light was lit up in an adjoining room. A serious shortcoming of this study was attempting to determine the nature of mind wandering based on external observation.

The limitation of Cohn, Hansel, and Sylvester's pioneering investigation into mind wandering can be credited with providing the author with the inspiration for a different modus operandi, namely the case study approach and the use of retrospection in order to directly examine the dynamics of listening to expository material, including intervening mental activities such as mind wandering and imaging.

The Study

Subjects

The subjects were fifteen paid volunteers attending Queensborough Community College which is a unit of City University. Participants were chosen to reflect the wide spectrum of students in attendance including

"late bloomers", career-seekers, members of minority groups, as well as the academically unprepared who constitute 50 percent of the population. Criteria for acceptance into the study included a demonstrated ability to verbalize about mental processes during a preliminary screening, and the completion or near-completion of a course in psychology.

Instruments and Description of the Testing Room

A taped lecture on the subject of conditioning was the chief instrument employed and was selected from the Sack-Yourman Study Skills Program (College Skills Center, 1971). Only the first side of the cassette lasting fourteen minutes was utilized. The other instruments were:

1. In order to test the accuracy of immediate exact recall in short term memory (STM), a variation of cloze called Op-In introduced by Pehrsson (1975) and adapted to an auditory experience, was utilized. Only the first four minutes of the lecture were used and deletions were positioned after every one and one-half sentences.

2. A flash-button device was in operation to allow subjects to signal the manifestation of intervening mental activity occurring in juxtaposition to ideas received during the lecture.

3. An easy-to-score check list of responses (based on the model of idea units) was used which was designed to incorporate the full range of "possible" responses which could be generated if total recall were possible.

4. A test of cue questions was designed to help subjects generate ideas which were stored but not freely recalled.

The testing room was an enclosed partition measuring ten by eleven feet. The furnishings consisted of a very large desk and two chairs; the

windows were covered to block out visual distractions. The special signalling and flashing equipment (two separate pieces) were placed for easy accessibility. Thus, the "signal-push" button was placed within the reach of the subject who was seated flanking the left side of the desk, and the "flash mechanism" was placed in the semi-open right hand drawer of the desk so as to be out of view of the subject.

Procedure

Testing was established as a two stage process. The first stage was set up as a trial run in order to determine the suitability of subjects for learning to integrate the separate tasks of listening and signalling followed by retrospection. Since subjects had to furnish a dual response in terms of recall of subject matter and awareness of intervening mental activity, it was important to train subjects as to when to push the flash-button to signal that intervening mental activity had occurred. Thus, subjects were exposed initially to a trial lecture, then asked to recall the trial lecture, and finally to retrospect about the reason for signalling at specific points during the lecture. Responses were reviewed in terms of content and triggering agent. Intervening mental processes such as mind wandering or thought extensions were defined as "not a flash association of 'pop-in, pop-out' experience, but rather a feeling of having been away and returned" with cognitive awareness arising only at the very end.

The second stage consisted of the actual test situation using the target message in the following order: (1) Subjects were first exposed to the Listening Op-In test using the first four minutes of the lecture. (2) Subjects then heard the main portion of the lecture lasting 10 minutes.

They were reminded that the investigator would be monitoring the appearance of flash signals which would then be mapped onto a verbatim copy of the lecture. (3) At the conclusion of the lecture, subjects were asked to recall. The directions specified:

> "Imagine that your class-mate was absent from a very important lecture that you attended. Write down all you can remember of the main ideas as completely as possible so that you could be of help."

(4) After the completion of the recall protocol, the investigator encouraged each subject to take a brief respite in order to give the investigator time to analyze the recall protocol for areas of omission and gaps in recall. (5) In order to trigger the retrieval of stored ideas not freely produced, subjects were asked open-ended questions based on specific gaps in their recall protocols. (6) Finally, subjects were asked to retrospect about their intervening thoughts. Specific questions were generated from an examination of the investigator's mapped copy of the lecture and were directed towards uncovering the associational stimuli and rationale for attentional departures at that particular context in time. Retrospection was generated by such questions as, "You pressed the push-button at about this sequence in the lecture. What were your thoughts at that time?" Responses were then recorded for immediate analytic purposes.

Scoring

The actual lecture consisting of 3000 words, was segmented into thirds in order to see the effect of beginning (primacy), ending (recency), and middle units of information on immediate, unaided, and aided recall.

Scoring procedures consisted of the following: (1) Responses to the Listening Op-In test were scored for accuracy of exact recall in STM.

In addition, calculations were made of the percentage of exact and semantic transformations (meaning equivalents). (2) The level of unaided recall in LTM was determined by analysis of the recall protocol which was matched against the text model which was an easy-to-score check list of responses incorporating the full range of "possible" responses if total recall were possible. The text model was an adaptation of scoring by idea units which was introduced by Cofer and reported by Meyer (1975). Under this approach, discourse was segmented on two levels--hierarchically as well as quantitatively according to meaningful units of information consisting of a word, phrase, or a clause. The first level consisted of information categorized as major or belonging to the highest order of information and was given a relative weight of five points for a total of twenty-seven. The second level consisted of subordinate ideas, each given as relative weight of one, for a total of 137. Using two judges, the reliability of scoring was established at 89.9 percent with a 95 percent level of confidence. The recall protocol also included non-quantifiable responses called elaborations which could not be scored because they were idiosyncratic. These responses included logical extensions* and additions which were the importation of novel facts or ideas which could be correct or incorrect. (3) Responses which were given to probe questions were computed in the same way as on unaided recall in order to gauge the percent gain in information. (4) Retrospective comments about intervening mental processes were recorded verbatim and then analyzed and categorized according to a post hoc schema. Behaviors which enhanced recall were considered to be facilitating and those which disrupted recall were considered to be interfering.

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*inferences

Limitations of the Study

Because of the complexity and speed of mental functioning, there was an error factor in pinpointing the exact moment in which intervening mental processes had occurred. In addition, the production and reporting of imagery was affected by individual idiosyncrasy.

Discussion of Findings

Exact Recall in STM

The mean percent of exact recall was 22 percent of the information. There was general agreement with other studies that exact recall in STM deteriorated rapidly, particularly with middle units, and was replaced by semantic transformations (Jarvella, 1971; Anderson, 1974). However, because of the nature of the test, the ease or difficulty of exact recall depended on factors such as serial order, concept load, repetition effects, and interference.

Unaided Recall in Long Term Memory

The mean percentage of unaided recall in LTM was 28 percent for the fifteen subjects; the range was 15 to 50 percent. This result compared favorably with other researchers: Meyer and McConkie (1973) found that the mean percentage of recall after hearing a passage was 23 percent; Marshall and Glock found a 24 percent mean recall response for community college students after reading two short passages.

In order to determine if there was a correlation between the recall of concepts (major ideas alone) and rank on unaided recall (composite score of major and subordination ideas) a Spearman Rank Coefficient Correlation was computed. Table 1 ranks each subject according to (1) com-

posite score obtained on major ideas and subordinate details, and (2) major ideas alone. According to the results, a significant correlation was found (.91 p. < .01) indicating that there was a strong relationship between the recognition of the hierarchy of ideas and recall. Johnson (1970) similarly found that the ability to recognize the structure was directly related to the level of recall.

Aided Recall

The increase in aided recall was strongly positive, with a mean gain of 16 percent, but not higher than unaided recall (table 2). Although the use of probe questions was a positive force in allowing stored information to surface, there was much individual variation depending on the strength or weakness on unaided recall which determined the amount of information available for later retrieval. This finding contrasted with Marshall and Glock (1978-79) who found that "probe recalls were significantly more complete than free recalls." However, it is difficult to make comparisons because the passages used by Marshall and Glock were very brief and thus the demands on LTM were very different.

Serial Order

Serial position effects were found in the present study (figure 1). There was a general tendency for recall to conform to the order of presentation with the greatest recall for the beginning (57 percent), followed by the last section (37 percent), and lastly by the middle (25 percent). These results seemed to be in agreement with those found by other researchers (Deese and Kaufman, 1957; Meyer and McConkie, 1973) and was particularly evident in passages developed sequentially.

Intervening Mental Activities

Intervening mental processes consisted of behaviors which could be facilitating or interfering to information processing. According to a post hoc analysis of responses, the most frequent intervening cognitive behavior which was considered to be facilitating was imagery, produced in response to concrete and vivid aspects of the lecture. Imagery occurred 31 percent of the time and was facilitating 88 percent of the time (table 3). Occasionally, however, imagery was disruptive particularly when the image assumed a more attractive life of its own. Thus, one subject reported, "I saw different colored lights in front of me that caused a mental block so that I did not recall that part of the lecture." Mind wandering was the next most frequent intervening behavior occurring 21 percent of the time and was interfering in its effect on retention 86 percent of the time, occurring mostly at the more abstract or peripheral aspects of the lecture. The other less frequent behaviors were: recalling information, flash association, personalizing, processing difficulties, and anticipation. In some cases, classification was difficult because some activities were not "pure" but seemed rather to merge into each other because of the complexity and speed of thought. For example, a quick flash association might be made to a stimulus word and then be diverted off to another mental pathway. Thus, in response to hearing the word "advertising," one subject immediately thought of a commercial "jingle" advertisement and thus wandered to a thought other than that being discussed at the moment.

There has been no reported retrospective study which attempted to analyze the components of intervening mental activities which are exemplified by mind wandering. Cohn, Hansel, and Sylvester's study (1971) focused on the frequency rather than on the nature of mind wandering;

however they suggested that mind wandering could be beneficial or harmful depending on the effect, i.e., whether it was related to "pondering more deeply the lecturer's theme," or rather "a pull from some other direction." Their speculations seem to have been substantiated in the present investigation.

Imagery as a Cogni[illegible]ve Tool

Montague and Carter (1973) found that concrete passages were easier to recall than abstract and suggested that imagery might play a role in recall. Similarly, in this study, the highest response rate was related to the most concrete aspects, and the lowest was related to the most abstract, specifically summaries and theoretical considerations. Paivio's hypothesis (1970), was confirmed that information is coded verbally and imaginally in memory, and that the use of both systems increases the chances for retention. The best recallers used both systems, although one relied exclusively on verbal mediators. Steingart and Glock (1979) interviewed students to investigate strategies used to facilitate recall and found that imagery was identified as the most frequent activity and the most facilitating.

Interactive Dynamics Expressed in Elaborati[illegible]e Behavior

The accuracy of recall was affected by interactive behavior between listener and the information, resulting in the production of elaborations. Some subjects freely imported and distorted the information, others were highly inferential, but there was much individual variation depending on the subject, prior experience, and the level of interaction. The greatest number of additions was seven and the largest number of extensions was ten, contributed by the most mature subject, who presumably

had the most experience (table 4). For example, one subject was able to recall the influence of the Russians on behaviorism because of his own reading on the subject. Similarly, those students who were familiar with modern art seemed to have readily visualized the painting referred to in the lecture. Reder's (1978) contention that interactive dynamics are involved in the processing of information resulting in elaborative behavior seems to have been confirmed in this study.

Retrospection and Imagery

Although most subjects experienced imagery to a greater or lesser extent, some were more hesitant or reluctant about communicating the nature of the thought process which had occurred. Horowitz (1970) cautioned about the problem of over-reporting (false-positive) and under-reporting (false-negative) which was not always successfully resolved in the present investigation. Specifically, in the initial stages of the study, leads suggested by subjects were not always followed-up and thus were probably under-reported. Under direct questioning, the highest ranking subject reported that she imaged throughout the lecture but suppressed reporting the information because she assumed that it was inappropriate. Despite strong attempts to control for suggestion, reports on the incidence of imagery increased, after the investigator became aware of its importance as an aid to recall.

Conclusions

1. There is no simple answer to the question, "What is the mind doing while listening to a lecture?" The mind is not reacting passively while being exposed to a stream of information. Rather, the mind is

engaged in a complex range of activities while listening, involving on the one hand, an active reconstruction of a message before it disappears; on the other hand, the mind is also beset by intervening mental activities which enhance or detract from the depth of processing which is occurring. In addition, interactive factors play an important role in the processing of information, resulting frequently in elaborative behavior.

2. The ability to comprehend and recall is complicated by the fragility of exact memory. However, it is not the ability to reproduce exactly heard information which determines the level of comprehension and recall, but rather the ability to reconstruct the message into a semantic counterpart before it disappears which is crucial. In addition, the level of recall is positively related to the ability to grasp the structure or hierarchy of concepts which then serve as a triggering mechanism or anchoring force in helping to store and release information clustered about different themes.

3. In general, the mind faces an uphill battle in an effort to recapture and reconstruct what is heard. For community college students, they were able to recall about one-fourth of the information; with assistance, they were able to recall an additional one-sixth.

4. As revealed during retrospection, because of the speed of thought and fluctuating levels of attention, the mind functions like a three-ringed circus in attempts to process, store, and retrieve the flow of information. In addition to conceptualizing, some of the intervening activities include: associating, anticipating, extending, imaging, recalling, personalizing, mind wandering, and processing what is heard. Imagery appears to be a frequent dynamic of thought, and when used appropriately, is probably an important tool in cognition and recall. Con-

versely, mind wandering, seems to be a temporary disruptor of thought because of the effect on the processing of the information, and occurring in response to the nature of the information being heard.

Implications

1. Since the mind faces an uphill battle in recapturing what is heard because of influences such as fluctuating attention, difficulties in concentration, inadequate conceptual frame, effects of serial order, proactive and retroactive interference, and linguistic factors, it is important for educators to become aware of the complex nature of information processing and to adjust their lecture methods accordingly. Some recommended specific procedural techniques are the following: (1) using varied audio-visual stylistic approaches to help maintain attention; (2) providing alternative methods of encoding and storing information by the use of such devices as the structural over-view and tree diagrams; (3) improving the reception of language by improving the verbal style of delivery, preferably by the use of vivid and concrete terms insofar as possible; (4) enhancing the conceptual base by the use of advance of post organizers, and encouraging pre-readings; (5) recognizing the effect of serial order, particularly the loss of middle units of information; therefore it is recommended that the high points of the lecture be placed toward the beginning or at the end; and (6) enhancing the process of retention by encouraging the use of verbal mediators such as suggesting that students list or outline briefly the main points of the lecture at the very end, before leaving for the next class.

2. Recognition should be given to the varieties of interactive intervening behaviors and their effect on retention which can appear during

the course of a listening experience. Thus, those behaviors which facilitate cognition and recall such as imaging, associating, extending, recalling, etc. should be maximized by the kinds of language and specific examples which are used during the course of a lecture. Conversely, attempts should be made to lessen the impact of intervening behaviors which interfere with the reception of a lecture by avoiding formats which allow for passivity or encourage daydreaming on the part of the listening audience. Students must be kept on their toes by the unexpected question, the unusual use of rhetoric, the unpredictable intellectual challenge, and the avoidance of rigidity. In addition, it is important for educators to reexamine their attitudes towards the manifestation of imagery since it has been demonstrated to be a helpful tool in cognition and recall.

Table 1

Unaided Recall: Composite Score of Major and Subordinate Ideas and Major Ideas Alone

Subject	Rank	Composite % Score of Major and Subordinate Ideas	Rank	% of Major Ideas (27)
Leslie	1	50	1	22
Andy	2	48	4	19
Donald	3	38	2	22
Tom	4	37	3	22
Olga	5	34	5	15
Sally	6	32	6	15
Betty	7	25	9	11
Bob	8	24	8	13
Edna	9	23	10	11
Cindy	10	22	11	11
Cathy	11	20	13	7
Dorothy	12	18	7	15
Lenny	13	18	12	11
Ira	14	16	14	9
Roberta	15	16	15	4
		$\bar{x}$ = 28%		$\bar{x}$ = 14%

r ≥ .91

p. < .01

Table 2

Percent of Gain in Overall Recall and Percent of Gain in Major Ideas Alone

Subject	Composite % Score of Major and Subordinate Ideas	% of Gain	Total overall Recall	% of Recall of Major Ideas Alone	% of Gain	Total
Leslie	50	10	60	22	7	29
Andy	48	9	57	19	7	26
Donald	38	16	54	22	15	37
Tom	37	13	50	22	7	29
Olga	34	13	47	15	7	22
Sally	32	21	53	15	13	28
Betty	25	16	41	11	15	26
Bob	24	10	34	13	4	17
Edna	23	11	34	11	11	22
Andy	22	30	52	11	22	33
Cathy	20	15	35	7	11	18
Dorothy	18	27	45	15	19	34
Lenny	18	24	42	11	19	30
Ira	16	15	31	9	15	24
Roberta	16	12	28	4	9	13
	$\bar{x}$ = 28	$\bar{x}$ = 16	$\bar{x}$ = 44	$\bar{x}$ = 14	$\bar{x}$ = 12	$\bar{x}$ = 26

Table 3

Intervening Activities and their Effect on Recall
(Unaided and Aided)

Activity	Total		Facilitating		Interfering	
	frequency total	% of Total (105)	frequency	%	frequency	%
	↓	↓	←	←	←	←
Imagery	32	31	28	88	4	12
Mind Wandering	22	21	3	14	19	86
Recalling	12	11	10	83	2	17
"other"	10	10	2	20	8	80
flash Association	8	8	4	50	4	50
Processing Difficulties	8	8	3	37	5	63
Personalizing	8	8	6	75	2	25
Anticipating	3	2	2	-	1	-
Extending	2	1	1	-	1	-
Total	105		59		46	

Table 4

Elaborative Behavior and Rank on Recall, and Number of Signals

Subject	(1) Rank on LTM (Unaided)	(2) Elaborative Behavior: Additions	(3) Elaborative Behavior: Logical Extensions	(4) Elaborative Behavior: "other"	(5) Light Flash # of Signals
Leslie	1	5	4	1	2
Andy	2	1	4	1	5
Donald	3	2	5	1	7
Tom	4	1	3	1	4
Olga	5	1	3	2	4
Sally	6	7	1	-	8
Betty	7	7	3	3	9
Bob	8	2	2	2	2
Edna	9	5	10	1	5
Cindy	10	5	5	2	5
Cathy	11	4	2	3	8
Dorothy	12	3	8	-	8
Lenny	13	3	0	2	3
Ira	14	2	0	1	4
Roberta	15	4	4	-	4
		$\bar{x} = 4$	$\bar{x} = 4$		$\bar{x} = 5$

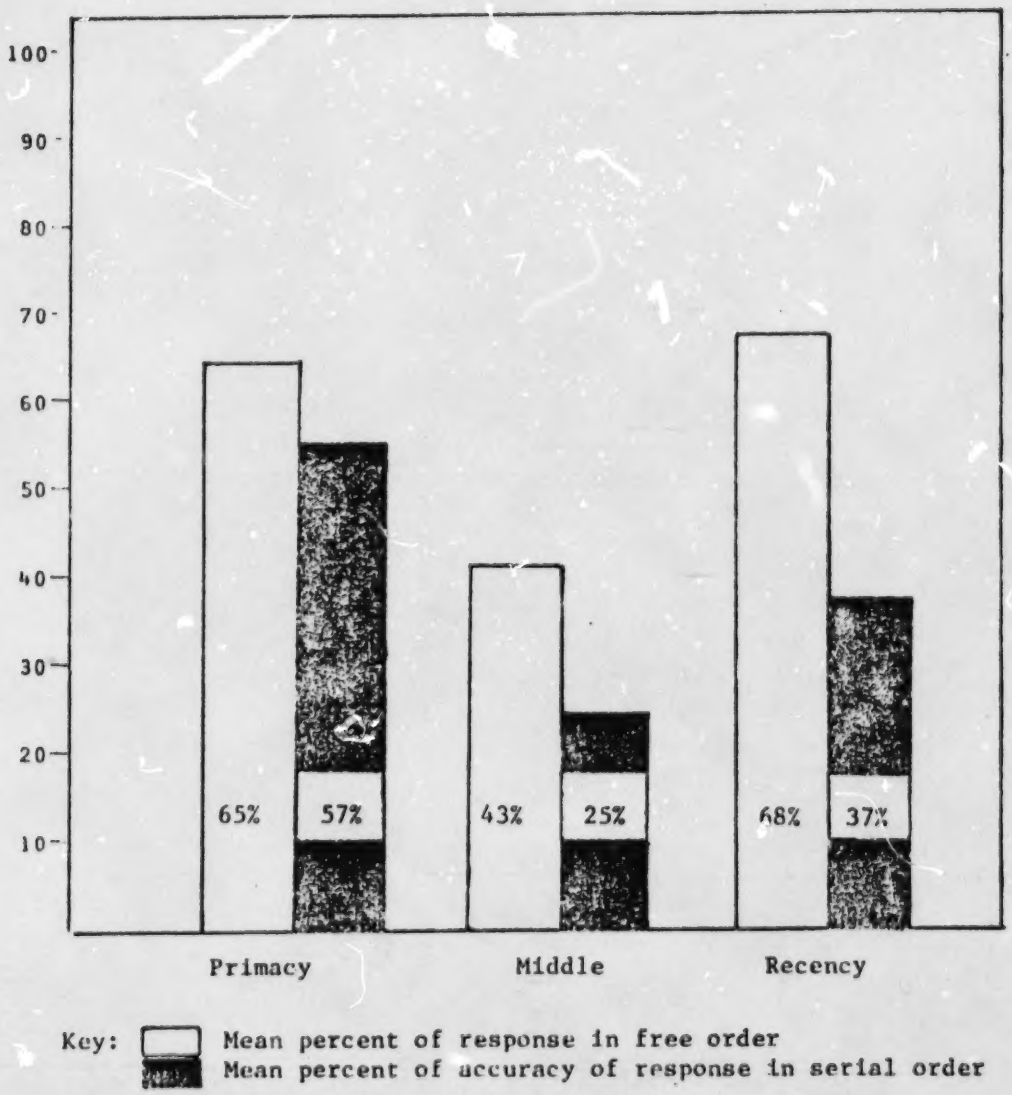

Figure 1

Unaided Recall: Comparison of Response in Segments of Time in Free Versus Serial Order

REFERENCES

Anderson, John R. "Verbatim and Propositional Representation in Immediate and Long Term Memory." Journal of Verbal Learning and Verbal Behavior, 13 (April, 1974), 149-62.

Anderson, Richard C. and Janet Hidde. "Imagery and Sentence Learning." Journal of Educational Psychology, 62, No. 6 (1971), 526-30.

Bartlett, Frederick C. Sir. Remembering. England: Cambridge University Press, 1950.

Bruner, Jerome. "The Course of Cognitive Growth." American Psychologist, 19 (January, 1964), 1-15.

Cohen, John, C. Hansel, and J. D. Sylvester, "Mind Wandering," Listening Readings, Vol. II, ed. Sam Duker. Metuchen, N.J.: Scarecrow Press, 1971, 48-51.

Deese, James and Roger Kaufman. "Serial Effects in Recall of Organized and Sequentially Organized Verbal Material." Journal of Experimental Psychology, 54, No. 3 (1957), 180-87.

Frederiksen, Carl H. "Effects of Context Induced Processing Operation on Semantic Information Acquired from Discourse." Cognitive Psychology, 7, No. 2 (1975), 139-66.

Gauld, Alan and G. Stephenson. "Some Experiments Relating to Bartlett's Theory of Remembering." British Journal of Psychology, 58, Nos. 1 and 2 (1967), 39-49.

Horowitz, Mardi S. Image Formation and Cognition. New York: Appleton-Century-Crofts, 1970.

Jarvella, R. J. "Syntactic Processing of Connected Discourse." Journal of Verbal Learning and Verbal Behavior, 10, No. 5 (1971), 409-16.

Johnson, Ronald E. "Recall of Prose as a Function of the Structural Importance of the Linguistic Units." Journal of Verbal Learning and Verbal Behavior, 9, No. 1 (1970), 12-20.

Kintsch, Walter and Ely Kozminsky. "Summarizing Stories after Reading and Listening." Journal of Educational Psychology, 69, No. 5 (1977), 491-99.

Marshall, Nancy, and Marvin Glock. "Comprehension of Connected Discourse: A Study in the Relationship between the Structure of Text and Information Recalled." Reading Research Quarterly, XIV, No. 1 (1978-79), 10-56.

Meyer, Bonnie J. and George McConkie. "What is Recalled after Hearing a Passage?" Journal of Educational Psychology, 65, No. 1 (1973), 109-17.

Meyer, Bonnie J. The Organization of Prose and its Effects on Memory. Amsterdam, Holland: North Holland Publishing Company, 1975.

Montague, W. and J. Carter. "Vividness of Imagery in Recalling Connected Discourse." Journal of Educational Psychology, 64, No. 1 (1973), 72-75.

Pehrsson, Robert. "Op-In Procedure." Paper presented at the meeting of the New York State Reading Association, Kiamesha Lake, New York, November, 1975.

Paivio, Allen. Imagery and Verbal Processes. New York: Holt, Rinehart and Winston, 1971.

Piaget, Jean and Barbel Inhelder. Mental Imagery and the Child: A Study of the Development of Imaginal Representation. New York: Basic Books, 1971.

Reder, Lynne. Comprehension and Retention of Prose: A Literature Review. Center for the Study of Reading. Technical Report No. 108, Cambridge, Massachusetts: Bolt Baranek and Newman, November, 1978.

Spiro, Rand J. Inferential Reconstruction in Memory for Connected Discourse. U.S. Educational Resources Information Center, ERIC Document 136 187, 1975.

Steingart, Sandra and Marvin D. Glock. "Imagery and the Recall of Connected Discourse," Reading Research Quarterly, XV, No. I (1979), 66-83.

APPENDICES:

(a) Sample Categorization of Retrospective Comments

(b) Sample Retrospective Comments of one Subject

SAMPLE CATEGORIZATION OF RETROSPECTIVE COMMENTS

Imaging the Information

I saw the dog and the way he was harnessed

I could visualize a robot type situation

I heard a bang

I thought of the Charlie Chaplin movie--Modern Times--and his working in the factory and his body getting stuck in all those weird positions

I imagined Rosalie with all those electrodes

I was trying to think what it was like in 1913; people riding around on bicycles and others holding parasols.

Mind Wandering

I thought of the Olympic games.

I was distracted by noises.

I kept thinking of my boyfriend.

He was talking very fast. I thought to myself, he had a Boston accent.

I was stretching

It got boring

I looked at a design in the wall. I noticed these dents were forming a straight line. I started to drift.

Recalling the Information

I studied a lot about behaviorism in Russian and politics. I was connecting that with previous learning.

I remembered reading about it (Peter and the Rabbit).

I connected what I heard with previous learning

I heard that axiom before, "Give me any children and I could turn them...."

"Other" including Disapproving, Feelings of Anxiety, Questioning

So what happened prior to 1913?

How cold it sounded!

I was becoming fearful that wouldn't remember.

The world would be in trouble if people could be changed into anything.

Flash Association

Communism and Freedom

I thought of my favorite commercial, "I'm Stuck on Band-Aids because Band-Aids are stuck on me."

I thought of "Salivate like Pavlov's Dog" (also Imagery)

I thought of the Titanic (also Imagery)

Processing Difficulties

I didn't understand

I couldn't connect to music. I couldn't see what music had to do with conditioning.

He was talking very fast. I would have liked him to go slower.

Personalizing the Information

I was thinking about being in a lab. I used to work in one.

I saw myself as being in the classroom.

How lucky that I'm not being conditioned.

I was thinking of me being Watson. Everything you wanted. Just one little thing and if they don't understand it, they destroy it.

Anticipating

It wasn't Peter. The name was Alvin. I knew what he would say before he said it.

I jumped ahead to what I thought would happen.

I was saying to myself, "out with it already."

Extending the Information

I was thinking of him applying his principles to advertising.

I could see how it could be correlated with what he was saying.

Retrospective Comments

Case # Olga

I. Free Retrospection: You pressed the button 4 times. Can you remember what you were thinking of?

---Going off ---Rabbit, learning about it in psychology ---Behaviorist Misbehaves. Funny, I could see the headlines.

II. Directed Retrospection

Sentence Cues	Verbatims	Category	Effect on Recall
1) Pavlov delayed the reaction, tried diff. kinds of stimulation. In fact, he even had a little box in his lab	1) I pictured his little laboratory with the dog in the cage on a table. Pavlov was in his lab coat and there is his little swear-word box	Imagery	Good
2) Any kind of behavior that is meaningful to the psychologist is behavior that can be measured	2) Don't remember	mind wandering	Bad
3) that a child can learn to fear anything and also learn not to be afraid of anything	3) I remember that I have a fear of heights on an overpass. I picture myself being afraid of overpasses when cars are below	Personalization and Imagery	Good
4) What happened to Watson. He is the first to apply in any systematic way the Pavlovian principles to American Psychology	4) I was thinking about him applying his principles in advertising. How strange! It just didn't seem right or it would work. Also, I could see the headlines, "Behaviorist Misbehaves!"	Questioning (other) Imagery	Bad Good